Refutation that experiments verify the relativity theory and a more reasonable proof of $E = mc^2$

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Abstract: When pointing out very serious mathematical errors in the relativity theory, people try to argue that the theory has been verified by a large number of physical experiments and therefore it must be correct. The presented paper looks at some of the most commonly presented experiments that claim to verify relativity theory and gives alternative explanations to the results of those experiments.

1. Introduction

This article gives alternative explanations to some physical experiments that are claimed to verify the relativity theory.

The relativity theory speaks too big words, of time slowing down, of mass increasing, of black holes, speed of light being c in all inertial frames, equivalence principle, and all that. When I look at it, I see only errors, serious errors.

Thinking about it all, it seems to me that the source of problems in the Special Relativity Theory is the idea that the physical world is four-dimensional, that time is a coordinate axis in a 4-manifold. Time is not a coordinate axis, though we can use it as a coordinate axis in diagrams and calculations. We are living in a three-dimensional space with movement. It is this idea of time as a coordinate that causes the error in the Lorentz transform.

The errors in the General Relativity Theory also arise from thinking of the space as a 4-dimensional manifold. Fundamentally the problem is the geometrization idea of gravitation. We can use geometric ideas in some situations, but it is not geometry. Thinking of geometry makes people to confuse dilation of time with slowing down of atomic clocks. Not all clocks slow down in higher gravitation. A pendulum clock ticks faster in higher gravity and a sundial, or the periods of day and night or winter and summer, do not change if you are in a higher or lower altitude. A second also does not change as it is defined by a measurement in a specified altitude.

But the biggest and most important open problem in the Relativity Theory is how this theory was ever accepted and how has it managed to stay accepted. The answer to this open question shows something very bad in science.

2. Another proof of $E = mc^2$

Experimental evidence that Olinto de Pretto's formula $E = mc^2$ holds include nuclear reactions where mass is turned into energy and particle physics experiments where a particle-antiparticle pair is either created or annihilated and energy is either released or tied. Let us look at the case of breaking an atomic nucleus.

In a nucleus elementary particles are tied by the strong force. Bombarding the nucleus with an elementary particle causes it to break into more units, or more units can combine into one. Energy is released and the mass of elementary particles before the breaking up sum to a smaller number than after the reaction. The sum m of lost mass and the energy E released agree with $E = mc^2$.

We will assume that in the physical world everything is finite. There cannot be infinitely small units of anything, thus time has the smallest unit t_u, distance has the smallest unit s_u, so also mass m_u, force F_u, pressure p_u, work W_u and energy E_u. Consequently, acceleration has the largest possible value a_u and velocity has the largest possible value which we assume to be c, the speed of light in vacuum.

Mass can be influenced by a force. If a mass is in a structure, like in an atomic nucleus, this structure may be able to withstand the force. Then the force only exerts pressure on the surface area of the mass that is on the direction of the force. If the structure cannot resist the force, it breaks. Then a unit of mass gets accelerated by the force. We assume this is what happens when a nucleus breaks up.

Pressure is

$$p = \frac{F}{A} \tag{1}$$

where A is the area. In our model where nothing can be infinitely small, the smallest area is s_u^2. We get the equation of the unit force from unit pressure

$$F_u = p_u s_u^2. \tag{2}$$

As the nucleus breaks up, this force is strong enough to do minimal work:

$$W_u = F_u s_u = p_u s_u^3. \tag{3}$$

This is the smallest unit of work. By conservation of energy it equals the smallest unit of energy:

$$E_u = W_u = p_u s_u^3. \tag{4}$$

The force accelerates a smallest unit of mass

$$F_u = m_u a_u \qquad \text{i.e.} \qquad \mathrm{m_u a_u = p_u s_u^2}. \tag{5}$$

From (3) and (5) we get

$$\frac{E_u}{m_u} = \frac{p_u s_u^3}{p_u s_u^2} a_u = a_u s_u. \tag{6}$$

The largest acceleration is speeding something from rest to the largest speed in the shortest time:

$$a_u = \frac{c}{t_u}. \tag{7}$$

This means that m_u is accelerated to the speed c in the unit time t_u. The mass vanishes when it is accelerated to c and turns into radiation. The largest velocity increase, i.e., the largest velocity, is c

$$c = \frac{s_u}{t_u}. \tag{8}$$

Inserting (7) and (8) into (6) gives

$$E_u = m_u \frac{c}{t_u} s_u = m_u c^2. \tag{9}$$

Summing up all mass units that turn into radiation in this nuclear reaction gives

$$E = mc^2. \tag{10}$$

Let us notice that this model where nothing can be infinitely small is a discrete model and it differs from a continuous model. In continuous mathematics, if a is constant acceleration, then

$$s = \frac{1}{2}at^2 \qquad v = at \qquad v = \frac{ds}{dt}. \tag{11}$$

In the discrete model there cannot be a distance $\frac{1}{2}s_u$ and there are no infinitesimals ds and dt. The corresponding formulas are

$$s_u = a_u t_u^2 \qquad c = a_u t_u \qquad c = \frac{s_u}{t_u}. \tag{12}$$

For smaller speeds v, the distance is a large number of units of s_u and the duration is a large number of time units t_u. Then continuous mathematics can be applied as a very good approximation and (11) holds for all practical purposes.

A discrete model is not Lorentz invariant. Those who still believe that the Lorentz transform is correct require that all equations of motion are Lorentz invariant. But the Lorentz transform has a fatal error, proven in [1], and there is no reason why equations of motion should be Lorentz invariant. The error can be easily explained. In the Lorentz transform

$$t' = \gamma(t - \frac{v}{c^2}x) = \gamma^{-1}t - \frac{v}{c^2}x' \tag{13}$$

time t' is a local time. The projection of (x', t') on the t'-axis is $t'_c = \gamma^{-1}t$. The speed of light in the moving frame cannot be calculated by dividing the distance by the time difference of local times in the end points of the trip of light. The duration must be calculated by taking projections of the end points to the t'-axis and calculating their difference. When this is correctly done, it turns out that the one-way speed of light in the moving frame is not c.

A discrete model explains e.g. why c is the largest local speed by (8). It does not mean that in a longer distance the speed of light in a moving frame cannot exceed c, it only means that locally c is the largest speed in the rest frame of reference.

So far we only discussed fission and fusion experiments. In experiments where a particle-antiparticle pair is annihilated two mass objects are collided. The collision cannot be an elastic collision because the masses are a particle and an antiparticle and conservation of quantum numbers does not allow any mass object to remain. What arises from the collision is radiation energy. The explanation is conservation of energy, momentum and quantum numbers. In experiments where a particle-antiparticle pair is created two beams of radiation are collided. Raditation has radiation pressure showing that a wave has momentum. Force is a time derivative of momentum, thus there are two forces colliding. Momentum, energy and quantum numbers are conserved and a possible result is creation of a particle-antiparticle pair.

Equations (1)-(10) give an alternative proof of Olinto de Pretto's formula. A fatal error in Einstein's proof of this formula is shown in [1]: mass does not grow with velocity. It is a very simple error that can be shown by an example. Lift a stone up to height h, let it fall down and collect energy. You collect more energy than was required to lift the stone up, meaning that this is a perpetual motion machine. The potential energy the stone has when it is at the height h is equal to the work it takes to lift it to the height h. But if the mass of the stone increases because of velocity, the kinetic energy it releases when it hits the ground is larger than the work to lift it to the height h. The only way that work equals kinetic energy and the force coming from kinetic energy equals the force doing the work when the stone hits the ground is that the mass does not increase because of velocity.

3. Another explanation for experiments deriving $m = m_o\gamma$

Einstein took the relativistic mass formula from earlier experiments that were explained by mass increasing because of velocity by just the relativistic mass formula. It is possible in a sense to derive the relativistic mass formula from $F = \frac{d}{dt}(mv)$ and the Lorentz transform, see [2], but this derivation makes questionable choices and the Lorentz transform has a fatal error, see [1]. Therefore the only justification for the relativistic mass formula is that some experiments seemed to confirm it. Yet, these experiments have another explanation, let us give it.

First we consider a simple analogue. In old times it was quite common to pushstart a car. At the beginning the car accelerated quite well by pushing it, but when the speed of the car was the running speed of the pushing person, the car did not accelerate any more. It is not that the mass of the car increased to infinity, it is that the force was not felt by the car having the same speed as the source of the force.

In the experiments that gave the results supporting the relativistic mass formula, an electron was moving with a constant speed v along the x-axis and it was deviated in the y-axis direction with an electro-magnetic force field.

Let us take a mass m moving to the positive x-axis with the speed v in the rest frame, the (x, y) coordinate system. The mass does not change with velocity. A field stationed in the rest frame exerts force to the mass. The propagation speed of the field is c in the rest frame. The field makes an interaction with the mass changing the momentum of the mass from some angle. This angle can be anything, the interaction can come from the direction parallel to the velocity v, from a perpendicular direction, or from any other direction.

To make the scenario clear: the mass is moving on the x-axis to the right. The mass is at $(0, 0)$ at the time $t = 0$. The source of the interaction is at the point (x, y), $y < 0$, in the negative y-half-plane, The distance of (x, t) from $(0, 0)$ is L. The line from (x, y) through $(0, 0)$ makes the angle ϕ with the x-axis. The angle ϕ can have any value from $-\pi$ to π.

The interaction changes both the mass's momentum and the field's. From this we conclude that the interaction is made with a two-way protocol of exchanging momentum. Let us propose the most simple two-way protocol for the interaction of the field with the mass with only two messages.

First the field sends a message to the mass, it takes time T_1. Then the mass sends a message to the field, it takes time T_2. When the mass receives the first message it is at the point $x = vT_1$. It sends the second message immediately, from the same point. The second message comes to the field at the time T_2. The total interaction time is $T = T_1 + T_2$.

From geometry we get the equations:

$$(cT_1)^2 = L^2 + (vT_1)^2 + 2LvT_1 \cos\phi \tag{14}$$

$$(cT_2)^2 = L^2 + (vT_2)^2 - 2LvT_2 \cos\phi. \tag{15}$$

Solving the equations gives

$$T_1 = \frac{Lv\cos\phi}{c^2 - v^2} + \frac{L\sqrt{c^2 - v^2 + v^2\cos^2\phi}}{c^2 - v^2} \tag{16}$$

$$T_2 = -\frac{Lv\cos\phi}{c^2 - v^2} + \frac{L\sqrt{c^2 - v^2 + v^2\cos^2\phi}}{c^2 - v^2} \tag{17}$$

and therefore

$$T = \frac{2L\sqrt{c^2 - v^2 + v^2\cos^2\phi}}{c^2 - v^2}. \tag{18}$$

Derivating T with respect to ϕ and setting the derivative to zero gives the equation for the extremal values of T as

$$\cos\phi \sin\phi = 0. \tag{19}$$

This means that the extremal points are at the values $\phi = n\pi$, $n = 0, 1, 2, ...$ for the maximum

$$T_{max} = \frac{2L}{c}\gamma^2 \tag{20}$$

and at the values $\phi = \pi - 2 + n\pi$, $n = 0, 1, 2, ...$ for the minimum

$$T_{min} = \frac{2L}{c}\gamma. \tag{21}$$

The interaction by the field deviates the mass from its orbit to the y-direction in these experiments. It adds the speed Δu to the mass m in one interaction of time T. The acceleration in the y-direction is

$$a_v = \frac{\Delta u}{T} \tag{22}$$

and as the interaction is perpendicular to the velocity of the mass, it is justified to use the formula (21) for T. The force is

$$F_v = ma_v = m\frac{\Delta u}{T} = m\frac{\Delta uc}{2L}\gamma^{-1}. \tag{23}$$

If the mass is at rest, $v = 0$ and the force is

$$F_0 = m\frac{\Delta uc}{2L}. \tag{24}$$

We see that

$$\frac{F_v}{F_0} = \gamma^{-1} \tag{25}$$

This formula (25) can be interpreted as supporting the relativistic mass concept. If we assume that the mass depends on velocity $m = m_v$, then instead of (23) and (24) we have

$$F_v = m_v a_v = m_v\frac{\Delta u}{T} = m_v\frac{\Delta uc}{2L}\gamma^{-1} \tag{26}$$

$$F_0 = m_0\frac{\Delta uc}{2L}. \tag{27}$$

Asuming that the moving mass m_v feels the force F_v as having the same strength as the force has for a mass m_0 that is not moving, then

$$F_0 = F_v. \tag{28}$$

From (26),(27) and (28) follows the relativistic mass formula:

$$m_v = m_0\gamma. \tag{29}$$

The assumption that a mass m_v moving with nearly the speed c could possibly feel the force accelerating it in the same strength as a mass m_0 that is at rest with the field is in clear contradiction with the experience how a car accelerates in a pushstart. Of course, a mass moving with nearly the speed c is moving away from the accelerating force almost as fast as the force can reach it. The mass cannot feel the force as a strong force. A more natural explanation for (25) is that the force becomes weaker when the velocity v grows. Yet, this explains why some experimentors did derive the relativistic mass formula.

We see in (20) that the time T could be longer than in (21), the increase of the time with speed could be twice as long as in (21). This very possibly has not been tested. Charged particles that are accelerated to speeds close to c are accelerated by a field that surronds them, therefore the angle ϕ is more like in (21). There may also be some principle that the interaction mostly happens in the fastest possible way and (21) gives a faster interaction than (20).

4. Another explanation for GPS clock advance

A favorite example that is offered as a proof of the relativity theory is the GPS clock. An atomic clock in a GPS satellite advances with respect to an atomic clock on the ground and this advance must be compensated. The advance is very closely the same that the relativity theory predicts. Yet, the way the relativity theory derives the correct formulas is very wrong and there is an alternative and much more reasonable explanation which gives exactly the same formulas for the GPS clock advance.

The relativistic calculation of the GPS clock advance has two parts: the contribution of gravitational time dilation which is smaller in the satellite than on the Earth, and the Lorentz transform time dilation in the satellite.

The formula for gravitationa time dilation in the General Relativity Theory (GRT) is

$$\frac{t_r}{t_\infty} = \left(1 - \frac{2GM}{rc^2}\right)^{-\frac{1}{2}}. \tag{30}$$

This formula is derived from the Schwarzschild solution to the Einstein equations. The Schwarzschild radius of a mass of the size M is

$$r_s = \frac{2GM}{c^2}. \tag{31}$$

In the first order approximation the time advance of the GPS satellite atomic clock to an atomic clock on the Earth surface is

$$\delta t_{grav} = \left(1 - \frac{GM}{rc^2}\right) - \left(1 - \frac{GM}{Rc^2}\right) = \frac{R-r}{r} g \frac{R}{c^2} \tag{32}$$

where $g = \frac{GM}{R^2}$. Inserting $R = 6.371 * 10^6$m, $r = 26.571 * 10^6$m,$g = 9.80665 m/s^2$ gives $\delta t = -45.784 \mu s$ in 24 hours (i.e., 86400 seconds). The clock in the GSP satellite advances.

The formula for Special Relativity Theory (SRT) time dilation from the Lorentz transform is

$$t' = \gamma t = \left(1 - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} t. \tag{33}$$

The speed v of the GPS satellite is calculated from equating the centrifugal force and the gravitational force

$$F = \frac{mv^2}{r} = \frac{GMm}{r^2} \qquad \text{giving} \qquad \mathrm{v}^2 = \frac{\mathrm{GM}}{\mathrm{r}}. \tag{34}$$

Taking the first order approximation from (33) and inserting v^2 yields

$$\delta t_{SRT} = \frac{1}{2}\frac{v^2}{c^2} = \frac{1}{2}\frac{GM}{rc^2}. \tag{35}$$

Inserting numbers gives $\delta t_{SRT} = 7.171 \mu s$. The velocity causes a delay to the GPS clock.

The total GPS clock advance to a ground based clock is $47.748 - 7.171 \mu s = 38.577 \mu s$ in 24 hours. The measured GPS clock advance is about $38 \mu s$ in 24 hours. This agreement seems too good to be true. It is too good to be true because while the formulas that this calculation uses are correct, their derivation is very incorrect.

The error in the SRT time dilation is that the Lorentz transform does not give (33). Solving x from $x' = \gamma(x - vt)$ as $x = \gamma^{-1}x + vt$ and inserting it to $t' = \gamma(t - (v/c^2)x)$ gives

$$t' = \gamma^{-1}t - \frac{v}{c^2}x'. \tag{36}$$

The projection of (x', t') on the t'-axis is $\gamma^{-1}t$, thus the time dilation (33) and the first order approximation (35) from the Lorentz transform should be

$$t' = \gamma^{-1}t \qquad \delta t_{SRT} = -\frac{1}{2}\frac{v^2}{c^2}. \tag{37}$$

The formula (37) claims that a clock in the moving frame advances compared to the one in the rest frame.

In order to show the error in the way the GRT time dilation formula is derived, let us look at the metric. The metric of the gravitational field is given by (using for clarity lower indices, upper indices get confused with powers)

$$ds^2 = g_{00}x_0^2 - g_{11}dx_1^2 - g_{33}dx_2^2 - g_{44}dx_3^2. \tag{38}$$

For light-like world paths $ds = 0$. If a world path is in the direction of x_i, $i \in \{1, 2, 3\}$, then $dx_j = 0$ for $j \in \{1, 2, 3\}$, $j \neq i$. For this world path the equation

$$0 = g_{00}dx_0^2 - g_{ii}dx_i^2 \tag{39}$$

Equation (31) gives the square of the speed of light on the direction of x_i, we set the speed of light initially to 1

$$1^2 = \frac{dx_i^2}{dx_0^2} = \frac{g_{ii}}{g_{00}} \tag{40}$$

Thus,

$$g_{ii} = g_{00} \tag{41}$$

for all $i \in \{1, 2, 3\}$. We can select a scalar function ψ so that $g_{00} = \psi^2$. In Cartesian coordinates ($x_1 = x, x_2 = y, x_3 = z, x_0 = ct$) the metric has the form

$$ds^2 = \psi^2 c^2 dt^2 - \psi^2 dx^2 - \psi^2 dy^2 - \psi^2 dz^2. \tag{42}$$

Because we set $x_0 = ct$, the speed of light in the above equation is c. This is the form of a metric that gives the speed of light as c to each space direction. It is a metric for a scalar field.

The main error in the General Relativity Theory is that there are no solutions that approximate Newtonian gravitation field around the Earth (or the Sun) that have the speed of light as c in vacuum to all directions at all points in the rest frame, see [1]. It is because the Einstein equations for a point mass in empty space have no scalar field solutions that approximate Newtonian gravity. There are tensor field solutions, like the Schwarzschild solution, which do approximate Newtonian gravity, but they do not have constant speed of light to all directions. From the metric of the Schwarzschild solution we can notice that if Cartesian coordinates are selected as (x, y) being in the horizontal plane and z as a vertical line, then the speed of light on the rest frame of the Earth is different in the horizontal plane and in the vertical direction, see [1]. We know from measurements that the speed of light in vacuum on the Earth is c to all direction with very good precision.

This fatal error means that General Relativity cannot predict the gravitational time dilation on the Earth or on a GPS satellite. The formula that General Relativity uses gives a good approximation, but there is no sense in using such a formula as it is not derived correctly from anything. We continue in deriving the same formula from the Newtonian gravitation field in an understandable and simple way, completely without General Relativity Theory.

The Newtonian gravitation potential is

$$\phi = -\frac{GM}{r} \tag{43}$$

The quantity of the Newtonian potential is m^2/s^2. We cannot use ϕ directly as ψ because ψ is a plain number at every point. We must scale the Newtonian potential by dividing it with the square of some speed. The only natural square of some speed to divide ϕ with is c^2, which already appears in the metric. Thus,

$$\psi = -\frac{GM}{c^2 r}. \tag{44}$$

In flat space $\psi = 1$, the metric (42) is

$$ds^2 = c^2 dt^2 - dx^2 - dy^2 - dz^2. \tag{45}$$

In order to get the gravitational time dilation, we must compare the time differentials: if in the flat space an atomic clock ticks one second, then in a gravitationa field ψ an atomic clock ticks $|\psi|$ seconds, the gravitational field causes a time dilation.

Applying this to the Newtonian ψ, if an atomic clock in flat space ticks one second, then an atomic clock on the Earth ticks

$$\delta t_{Earth} = \frac{GM}{c^2 R} \tag{46}$$

seconds where R is the radius of the Earth. In the satellite an atomic clock ticks

$$\delta t_{satellite} = \frac{GM}{c^2 r} \tag{47}$$

seconds where r is the distance of the satellite from the center of the Earth.

The time advance in the GPS satellite caused by gravitational time dilation is

$$\delta t = \delta t_{Earth} - \delta t_{satellite} = \frac{GM}{c^2}\left(\frac{r}{Rr} - \frac{R}{Rr}\right) \tag{48}$$

$$\delta t = \frac{1}{c^2} g \frac{R}{r}(R - r) \tag{49}$$

where $g = \frac{GM}{R^2}$. This is exactly the formula that the calculation based on the General Relativity Theory gives, only there the formula itself is only an approximation and here it is exact.

This time advance is higher than the observed GPS clock advance. We must find another effect that causes clock change. In the relativity theory calculation this other time change is time dilation from the Lorentz transform (35). The formula is correct, but the derivation is wrong, the Lorentz transform gives (37). But the Lorentz transform is wrong as is proven in [1]. We have to find another way to derive this formula.

There is the centrifugal force affecting the satellite. Einstein thought that gravitation and acceleration should have similar effects, therefore if gravitation causes time dilation, so should acceleration. Acceleration from the centrifugal force is calculated by equating the centrifugal force and $F = ma$

$$F = ma = \frac{mv^2}{r} \tag{50}$$

thus

$$a = \frac{v^2}{r}. \tag{51}$$

We will continue to look for a way to get the acceleration time dilation that is a direct analogy to the way to get the gravitational time dilation, which we used above and which is

$$\delta t = |\psi| = |\frac{\phi}{c^2}| \tag{52}$$

which is to be read as: if in flat space clock ticks one second, then it ticks $|\psi|$ seconds in the gravitational field.

A gravitational field is gravitational potential energy per mass:

$$\phi = \frac{E_p}{m}. \tag{53}$$

When energy is conserved, work equals energy. We can generalize (52) to acceleration time dilation in the following way

$$\delta t = \frac{W}{c^2 m} = \frac{Fs}{c^2 m} = \frac{mas}{c^2 m} = \frac{1}{c^2} as \tag{54}$$

where $W = E_p$ is work, F is force, m is mass, a is acceleration, s is distance.

It remains to calculate the distance s. The orbit of the satellite is a circle. Let us draw a radius r from the center to the orbit. Without a force the mass would continue along a straight line perpendicular to the radius. This line has the length $r\Delta\alpha$ for some small angle $\Delta\alpha$. These two lines give sides of a triangle with one perpendicular angle. The hypothenuse of the triangle has the length $r + \Delta r$ where

$$(r + \Delta r)^2 = r^2 + (r\Delta\alpha)^2 \tag{55}$$

Acceleration a causes the mass to move the distance Δr and remain in the circular orbit. Solving Δr from (55) gives

$$\Delta r = \frac{1}{2} r(\Delta\alpha)^2 + O((\Delta\alpha)^4). \tag{56}$$

We need to go from a small displacement Δr into an infinitesimal ds. It would be incorrect to write

$$ds = \frac{1}{2} r(d\alpha)^2 \tag{57}$$

because the order of an infinitesimal must be the same on both sides. We must write

$$ds = \frac{1}{2} r d(\alpha^2) \tag{58}$$

where $d(\alpha^2) = 2\alpha d\alpha$ is a first order infinitesimal like ds.

Inserting $\omega = \frac{d\alpha}{dt}$ gives

$$ds = \frac{1}{2} r\omega^2 d(t^2) = \frac{1}{2} r \frac{v^2}{(2\pi r)^2} d(t^2) = \frac{1}{2} r \frac{v^2}{(2\pi r)^2} dy \tag{59}$$

where we have written for clarity $dy = d(t^2)$. Integrating

$$\int_0^s ds = \int_0^{T^2} \frac{1}{2} r \frac{v^2}{(2\pi r)^2} dy \tag{60}$$

$$s = \frac{1}{2} r \frac{v^2}{(2\pi r)^2} T^2 \tag{61}$$

where

$$T = \frac{2\pi r}{v} \tag{62}$$

is the time for one round around the circle. Inserting T gives

$$s = \frac{1}{2} r \frac{v^2}{(2\pi r)^2} \frac{(2\pi r)^2}{v^2} = \frac{1}{2} r. \tag{63}$$

This is the distance s that force F in (54) works. Inserting to (54) gives

$$\delta t = \frac{1}{c^2} as = \frac{1}{c^2} \frac{v^2}{r} \frac{1}{2} r = \frac{1}{2} \frac{v^2}{c^2}. \tag{64}$$

Thus, calculating the time dilation caused by acceleration by the centrifugal force gives exactly the correct formula that the relativistic derivation uses but cannot correctly justify:

$$\delta t = \frac{1}{2} \frac{v^2}{c^2}. \tag{65}$$

There is no time dilation because of velocity, the Lorentz transform is wrong, it does not take the projection of the point (x', t') on the t'-axis when calculating speeds, see [1].

As we derived exactly the same formulas as are used in the relativistic calculation, we also get a remarkable agreement with the measured GSP clock advance.

Notice that the relativistic calculation ignores the time dilation caused by the acceleration on the circular orbit. Einstein claimed that there is full equivalence between gravitation and acceleration, that a person could not tell if he is in accelerating motion or if he is in a gravitation field. If so, then one should not at all calculate the gravitational time dilation in the satellite because the centrifugal acceleration completely cancels gravitation acceleration. If so, the relativistic calculation is wrong as it ignores time dilation by acceleration. But we see that Einstein's claim of full equivalence of acceleration and gravitation is not true: time dilation by gravitation in the satellite is not equal or cancelled by time dilation caused by acceleration. Both must be calculated. But when we do so, there is no place any more for any Special Relativity Theory time dilation caused by the Lorentz transform. Our calculation does not have time dilation because of velocity and it gives the same result as the relativistic calculations, agreeing very well with measurements.

5. Another explanation for time dilation in a muon

There are several experiments that claim to verify that there is time dilation because of velocity. One of them involves muons. Muons are unstable elementary particles and they have an averal lifetime. In the experiment muons are created in a particle accelerator, then they are speeded to a velocity very close to c and they are directed to a bubble chamber where one can see how they decay. It is observed that the lifetime of these muons is longer. The length of their lifetime agrees with the calculations of time dilation from the Lorentz transform. This is interpreted as a verification that time dilation as in the Lorentz transform is true and has been observed.

However, such interpretation is invalid. No finite number of experiments where a theory agrees with what experiments show can prove that a claim of the theory is true and observed. A theory can only be falsified by experiments. This is because there can always be alternative explanations to those experiments and we cannot know all possible (and not necessarily ever invented) alternative explanations in order to check them all. In the muon experiment what we see need not be time dilation because of velocity, it can be time dilation because of acceleration.

A theory can be falsified if it has serious mathematical errors. The Lorentz transform is falsified in this way. Some theories can be proven sound, i.e., not having self-contradiction, by mathematical means. SRT has self-contradictions, one is seen by comparing (33) and (37) and for others see [1].

In this particular experiment there is the stage when muons are accelerated. We saw in Section 4 that acceleration by the centrifugal force did cause a time dilation. We should see the same here.

Let us for simplicity assume that muons are accelerated by constant acceleration a. As in (54)

$$\delta t = |\frac{W}{c^2 m}| = \frac{1}{c^2} as. \tag{66}$$

The distance s is very simple to find out in this case of constant acceleration

$$s = \frac{1}{2} a t^2. \tag{67}$$

Therefore

$$\delta t = \frac{1}{c^2} a^2 t^2 = \frac{1}{2} \frac{v^2}{c^2} \tag{68}$$

the same formula as (33). Notice again, that the Lorentz transform would give (37), not (33).

6. The Sagnac experiment does refute SRT

The Sagnac experiment has a number of nodes on a circle. They are capable of relaying light to each direction so that light travels from a selected starting node around the circle back to the starting node. Light is sent to both directions and when the beams arrive back to the starting node, they are directed to a radial direction with respect to the circle and allowed to interfere. The circle rotates. Consequently the path around the circle is shorter in one direction than in the other, there is a phase shift between the two beams and they produce an interference pattern.

In the original experiment the nodes are mirrors and the circle is not a large one, but we can take the nodes as communication satellites. They can relay signals to each others and we can imagine many such satellites around the world so that the light beams go around the world. Between the nodes light follows a straight line in practical vacuum. As we saw in Section 4, an atomic clock in a satellite advances with respect to an atomic clock on the ground due to gravitation and acceleration time dilation. This effect at the satellites adds the same amount of time to the transmission time to the light beam travelling to both directions. It does not cause any phase difference to light beams traveling to different directions through the satellites. Indeed, nothing in the satellites treats the beams going to the two different directions any differently, satellites do not cause any phase difference between the beams in two directions. The only way there can be a phase difference between the beams travelling to opposite directions is that the speed of light is not the same to both directions. The phase difference is measured. This means that SRT is wrong: the one-way speed of light in the moving inertial frame is not c to both directions.

The Sagnac experiment shows what happens with the method that Einstein uses in order to "show" that the speed of light in the moving frame in the Lorentz transform is c to both directions. He calculates the speed of light as the difference of displacement on the x'-axis divided by the time difference of the local time t' in two different points. The time t' is a local time because it satisfies the equation $t' = t'_c - (v/c^2)x'$ where $t'_c = \gamma^{-1}t$ is the projection of (x', t') on the t'-coordinate axis. In the situation above with satellites circulating around the world, we select the first node as $x' = 0$ and the distance to the next satellite as $x' = L'$. There the satellite clock is behind the clock of the first satellite by $(v/c^2)L'$. We continue to the next satellite. Its clock will be behind that of the first satellite by $2(v/c^2)L'$ and so on, until we come again to the first satellite and get a self-contradiction as the clock of the first satellite is already set and we should set it much behind. In the time-zone system on the Earth we have the same situation: at some place the local time must jump by 24 hours. This should explain why t' is indeed a local time and the speed of light cannot be calculated by using the difference of t' values as the duration.

Amazingly, supporters of relativity theory "explained" how this experiment is not in contradiction with SRT, while it clearly is. But these supporters of relativity theory also "explained" how the twin paradox does not refute SRT, though it clearly does.

There is no way to explain this experiment so that it would not refute SRT. Therefore the strategy of these "explainers" is to point out that the satellites are not inertial reference frames as they travel along a circular path, therefore

SRT does not apply in this situation. Yet, according to the same supporters of relativity theory, SRT does apply to GPS satellite clock time advance. SRT does apply in this situation. The circular path causes acceleration, but it is in the satellites and cannot cause a phase difference between the two beams. The reason why these "explainers" want to go to GRT is that then one can talk all kind of mumble-jumble of world paths. But GRT is also wrong and it is no way out.

7. The twin paradox does refute SRT

A sad example of cheating by Einstein is his "explanation" of the twin paradox. The Lorentz transform gives a formula to compare the proper time of two inertial frames of reference A and B. The proper time of the moving frame ticks slower. We can choose A or B as the moving frame of reference. Therefore, if there are two twins, one on A and the other on B, then which twin ages faster depends on our choice of which frame is moving.

Einstein's "explanation" was that the times in the frames A and B cannot be compared unless the word paths meet at the start and at the end. The Lorentz transform does not give any requirements for the distance of the origins of the inertial frame cordinate systems (x, t) and (x', t'). The origins can be light years away. The Lorentz transform does not require anything that any word paths should ever meet. Einstein's explanation adds new requirements that are not in SRT and therefore the twin paradox does refute SRT.

There is no need to compare times between two inertial frames that move with respect to each other in order to refute SRT. We can refute the Lorentz transform and thus SRT e.g. in the following way.

Let us consider two cities, say Helsinki and Stockholm. Assume you are in Helsinki at the present moment, does Stockholm exist at that present moment? That is, can it be so that Stockholm does not any more exist when you are in Helsinki at the present moment, but it did exist some time ago? Or can it be so that Stockholm does not yet exist when you are in Helsinki at the present moment, but Stockholm will exist in the future? Cities do not cease to exist and then again appear to exist. We must conclude that Stockholm does exist at the same present moment when you are in Helsinki. The present moment is the same everywhere and there is no other time moment that exists, past is gone and future has not yet come. The present moment gives a meaning of what is synchronous. In the whole physical world only the present moment actually exists. Only a clock time can be different in different places, not the present moment. One should not confuse the measure of the duration of time with a clock with what the time reall is, that is: only the present moment exists and there is movement.

A clock in Helsinki shows one hour more than a clock in Stockholm. This is because Helsinki has a different local time than Stockholm. If you fly from Helsinki to Stockholm, the flight time is about one hour. The local time different is about zero. Clearly, the speed of the airplane cannot be correctly calculated by dividing the distance with the difference of the local times at the start and destination. A local clock time difference does not give duration.

However, this is exactly what the Lorentz transform is proposing. Solving x from $x = \gamma(x - vt)$ and inserting to $t' = \gamma(t - (v/c^2)x)$ gives the formula $t' = \gamma^{-1}t - (v/c^2)x'$. The time t' is a local time. If we consider the Earth as the moving frame in the Lorentz transform and put the origin of (x', t') to place A, then this formula means that there is an atomic clock in place A and an atomic clock in place B and the clock in place B is delayed by $(v/c^2)x'$ where x' is the distance from place A to place B.

According to the Lorentz transform, the speed of light in vacuum sent from place A to place B is c only in case we measure it with two clock that are not at the same time. But we know from experiments on the Earth that the speed of light in vacuum from place A to place B is c only if we use two clocks that show the same time. SRT fails this simple test.

The argument that supporters of the relativity theory give is that in some way the people in place A and place B would not notice that the clocks are not at the same time. But they would. There are ways to synchronize clock times: we can synchronize the clock time in place A and place B e.g. with the transmission system of the communication network or with time from a satellite. If the moving frame of reference is chosen as the Earth, people on the Earth would not measure the speed of light on the Earth with two clocks that are not ticking at the same time.

8. Einstein's three experiments for verifying General Relativity

Einstein proposed three tests of General Relativity. The precession of the perihelion of Mercury is calculated in [3]. The paper first shows that the solution by relativity theory is shown false, a stone falling in a gravitation field does not accelerate in Einstein's geodesic metric. Then the paper makes a more detailed calculation of the effects of other planets based on Newtonian physics. The results seem to explain the measured precession speed. Before Einstein some astronomers had tried to calculate the precession speed, but one has to use approximations when calculating the effect of other planets: a multibody problem does not have an analytic solution. They got a good approximation for the precession speed, but it had a small error. Einstein knew this error and presented the situation in a way that the correct precession speed cannot be derived from Newtonian physics. He gave a relativistic calculation that perfectly covered this error. This is strange since the error was caused by approximations in the effect of other planets and such an approximation error cannot be corrected in any other way than by making better approximations. If a mechanims that had not been considered fully agrees with the error caused by approximations, then one can suspect that there may be something wrong.

The second test was bendling of light close to the Sun. As the General Relativity

Theory does not allow any solution that approximates Newtonian gravity around the Sun and has the speed of light locally constant c to all directions, General Relativity Theory fails this test. Light bends in the metric (38), which is the metric of Nordström's scalar gravitation theory. The metric is induced by a scalar field and a scalar field is an image of a conformal mapping from flat space. As light travels on a straight line in flat space, it bends in the image of a conformal mapping. Einstein incorrectly claimed that light does not bend in Nordström's theory and this claim has been often repeated, but it is false. It is claimed that Eddington could not have observed this bending of light in his famous experiment. Light does bend, it has been verified in later experiments, but it may be that Einstein knew it before Eddington's experiment, possibly he saw some results from an earlier eclipse. If so, this was not a test of the theory. In any case, GRT fails this test: GRT does not have even a field solution that could be compared to measurements around the Sun.

The third test was the gravitational time dilation. It was verified by the Pound-Rebka experiment. As is explained in Section 3, this gravitational dilation formula comes from the Newtonian gravitation potential and the scalar metric of Nordström's gravitation theory. It does not come form General Relativity Theory because General Relativity does not have any solutions that approximate Newtonian gravity and have the speed of light constant c to all directions.

9. References

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